Allergologia et immunopathologia
Sociedad Española de Inmunología Clínica, Alergología y Asma Pediátrica
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ORIGINAL ARTICLE

OPEN ACCESS

The effects of maternal anxiety and attitudes on the adherence to inhaled corticosteroids in children with asthma

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Received 25 August 2020; Accepted 15 December 2020
Available online 1 May 2021

KEYWORDS
asthma;
children;
mothers;
anxiety;
attitude;
adherence

Abstract
Objective: Long-term inhaled corticosteroid (ICS) use in children with asthma causes serious concerns in parents, leading to treatment non-adherence. This study aimed to investigate the effect of maternal anxiety and attitudes on adherence to ICS therapy in children with asthma.
Method: The patient group included the children with mild to moderate persistent asthma, aged 6-11 years. Healthy children in a similar age range were included as a control group. The patient group was divided into two categories (treatment adherent and non-adherent) according to the regularity of ICS use. All patients were assessed with Childhood-Asthma Control Test (C-ACT), and their mothers were assessed using Parent Attitude Research Instrument (PARI) and Beck's Anxiety Inventory (BAI).
Results: A total of 156 children (age: 7.4 ± 1.4 years, F/M: 71/85) with persistent asthma and 60 healthy children (age: 7.5 ± 1.3 years, F/M:25/35) were included in the study. The rate of adherence in children with asthma was 52.6%. Mothers of non-adherent patients had significantly higher BAI scores than those of the adherent patients and controls ($p<0.001$ and $p<0.001$, respectively). The number of mothers who indicated that they did not have enough information about asthma and treatment was also higher in the non-adherent group. PARI subtest scores were not different between the adherent and non-adherent groups.
Conclusions: In our study, it was found that mothers' anxiety levels and their knowledge about asthma and medications were associated with treatment adherence in children with asthma. Psychological and educational support to the families of children with asthma would improve their treatment adherence and efficacy.

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https://doi.org/10.15586/aei.v49i3.196

Introduction

Asthma is one of the most prevalent chronic childhood diseases and imposes a severe social and financial burden on families and communities.[1] Inhaled corticosteroid therapy (ICS) is a prominent therapy in the control of asthma. However, as in other chronic diseases, long-term corticosteroid use raises parental doubts about the necessity for the medication.[2] Parental concerns such as adverse reactions to the medication lead to poor treatment adherence and thus poor asthma control. Studies note adherence to therapy at rates of 70%, at best, despite the accurate diagnosis and appropriate treatment.[2] It is crucial to define and avoid the factors altering the treatment adherence to be able to improve outcomes. Studies have shown that the age of the child,[3] the ease of use of the medication device,[4] the family's level of knowledge about the disease and treatment,[5,6] and the education level of the family affect the treatment adherence.[7,8]

In most cases, the mother is the primary caregiver and bears the responsibility to manage the child's asthma at home, which may constitute a significant burden and adversely affect the mother's mental health, leading to problems such as anxiety disorder and depression.[9-11] On the other hand, the development or outcome of asthma attacks might be affected by the mother's mental health. Several studies have indicated an association between maternal distress and the outcome of asthma.[10-12]

The Parent Attitude Research Instrument (PARI) has been frequently used in evaluating parental attitudes in child care.[13] This scale evaluates overprotective mothering, democratic attitude and equality, the attitude of hostile rejection of homemaking role, marital conflict, and authoritarian attitude. The effect of pediatric asthma on maternal mental health has been examined more commonly, but its effect on mothers' attitudes has been studied less frequently. The relationship between treatment adherence in childhood asthma and the mothers' attitudes and anxiety is not clear.

This study aimed to investigate the effect of the mothers' attitudes and anxiety levels on the adherence to ICS therapy in children with asthma.

Methods

Study population

This study was conducted in the Pediatric Immunology and Allergy Unit in the Department of Pediatrics, Başkent University School of Medicine, İzmir, Turkey. The study protocol was in accordance with the Helsinki Declaration, approved by the Institutional Review Board of Başkent University (Project no: KA18/233), and supported by Başkent University Research Fund. The study group included the children who had mild to moderate persistent asthma, aged 6–11 years, received ICS treatment, and had been followed up for at least 6 months. The exclusion criteria were as follows: having a native language other than Turkish, having another chronic childhood disease, and the medical history of a psychiatric/neurological disorder in the mother. The definition of asthma was based on the Global Initiative for Asthma (GINA) guideline criteria: paroxysmal cough, wheezing, breathlessness, or chest tightness with either an increase in FEV1 of at least 12% or 200 mL after salbutamol administration or significant airway hyperresponsiveness.[14]

Study procedures

At the first visit, all patients were informed about asthma (it was explained that asthma is a chronic inflammatory disease and ICSs are used to control inflammation and continue to use it until the next visit), medications (they were shown how to use a metered-dose inhaler [MDI] with the spacer or a dry powder inhaler [DPI] and checked if they used them properly), treatment duration, and adverse reactions. They were also given information pamphlets describing the treatment in a simple way. Their questions about the treatment were answered, and a diary was given to the mothers to record their daily symptoms and medication use. The patients and their mothers were informed about the study. Informed consent was obtained from all individuals who wanted to participate in the study. The patients' demographic data (i.e., age, gender, parents' education, and income level) and medical data (i.e., the severity of asthma and prescribed medications) were noted. The follow-up visits were scheduled for 1–3 months later.

At the second visit, the patients' diaries were evaluated. It was cross-checked with the diaries and prescription data to assess treatment adherence. The patients who used at least 80% of the planned medication at the first visit were categorized as treatment adherent. Those who did not comply with the treatment plan (who discontinued the treatment or used less than 80% medication) were considered non-adherent.[15,16]

Children with asthma were assessed with Childhood-Asthma Control Test (C-ACT); their mothers were assessed with PARI and Beck's Anxiety Inventory (BAI) and asked if they consider their knowledge about asthma, adverse reactions, treatment duration, and the time of next visit sufficient. Besides, non-adherent patients were given an additional questionnaire about why they stopped the treatment (no more asthma attacks, concerns about side effects, inability to obtain the medication due to financial difficulties, etc.) and about who was effective in the decision to discontinue treatment (the mother, father, mother and father, child, friends, etc.). A detailed physical examination and pulmonary function tests were performed on all patients at each visit.

The control group consisted of age- and gender-matched patients admitted to the pediatric outpatient clinic visit for well-child monitoring and their mothers. Any individual (children or their mothers) who had a history of any chronic or psychiatric disease were excluded. Demographic data of the control group were recorded, and PARI and BAI tests were applied to the mothers.

Childhood-Asthma Control Test (C-ACT)

Childhood-Asthma Control Test (C-ACT) was developed by Liu *et al*.[17] in 2007; Sekerel *et al*.[18] adapted the test to Turkish patients in 2009. C-ACT can be applied to children

aged 5 to 11 years and consists of four questions for the child and three questions for his/her parents. The scores range between 0 and 27 points; scores below 19 indicate "poor disease control". Patients' asthma control levels were evaluated as "*controlled*" or "*poorly controlled*" based on their C-ACT scores.

The Parent Attitude Research Instrument (PARI)

The Parent Attitude Research Instrument (PARI) was used to evaluate the parental attitudes on child care. Schaefer and Bell[13] first developed this self-report instrument in 1958. In 1978, LeCompte *et al*.[19] adapted the instrument to the Turkish language with high test-retest reliability. PARI consists of 60 items in five subscales as follows: "overprotective mothering" indicating an attitude of an over-controlling, anxious, and over-demanding parental attitude; "democratic attitude and equality" referring to an encouraging, supportive, and sharing relationship; "rejection of the homemaker role" referring to nervous, distressed, and angry mothers in relationship with their children; "marital conflict-discord" refers to marital discordance in child-rearing activities of the parents; "authoritarian attitude-strict discipline" reflects strict discipline, over-punishing, and a rigid parental attitude. High scores indicate negative and anti-democratic parent (mother, in this case) attitudes.

The Beck Anxiety Inventory (BAI)

The Beck Anxiety Inventory (BAI) was developed by Beck *et al*.[20] to determine the frequency of anxiety symptoms in the patient. The validity and reliability study for the Turkish version was conducted by Ulusoy *et al*.[21] with a Cronbach's alpha coefficient of 0.93. BAI consists of 21 statements, which refer to a condition concerning anxiety. A score between 0 and 7 refers to "minimal anxiety", 8-15 indicates "mild anxiety", 16-25 indicates "moderate anxiety", and 26-63 shows "severe anxiety".

Statistical analysis

The study sample size was calculated using G*Power 3.1.9.2 (Dusseldorf University, Germany). The minimum sample size was calculated as 52 when ¤-error is 0.05, and power (1-β error) is 80% (goodness-of-fit tests for contingency tables) as the previously reported treatment adherence in asthma was 30-70%.[22] Statistical analyses were performed using IBM SPSS 21.0 (Statistical Package for Social Sciences, SPSS, Inc., Chicago, IL). The results were expressed as the number of cases (percentage) for categorical data or mean ± standard deviation for continuous data. Non-normally distributed data were presented using medians, minimum-maximum, and interquartile range (IQR). The groups were compared using χ2-test for categorical data or either the one-way analysis of variance (ANOVA) or Student's *t*-test for continuous data as relevant. These non-normally distributed data were compared by Kruskal-Wallis tests. Tukey's post hoc analysis was used for pairwise comparisons. Correlation analyses were performed using Pearson correlation analysis; p-values <0.05 were considered statistically significant.

Results

A total of 156 children (female (F)/male (M): 71/85) with mild to moderate persistent asthma with a mean age of 7.4 ± 1.4 years were in the asthma group. Sixty healthy children (F/M: 25/35) with a mean age of 7.5 ± 1.3 years were included in the study as the control group. The adherence to the treatment was 52.6% among children with persistent asthma. The number of working mothers in the control group was significantly higher than the asthma group ($p<0.001$). Besides, the income level was significantly lower in asthma patients compared to the controls ($p<0.001$). The demographic characteristics of all participants are summarized in Table 1.

Table 1 Demographical characteristics of adherent and non-adherent patients with asthma and the healthy controls.

	Non-adherent (n=74)	Adherent (n=82)	Controls (n=60)	p
Age (year) (mean ± SD)	7.4 ± 1.4	7.4 ± 1.7	7.5 ± 1.3	0.799
Mother's age (year) (mean ± SD)	37.5 ± 4.6	36.2 ± 4.6	36.9 ± 5.1	0.243
Gender (F) n (%)	38 (51.4)	33 (40.2)	25 (41.7)	0.332
Obesity (BMI > 85p) n (%)	18 (24.3)	12 (14.6)	10 (16.7)	0.271
Working mother, n (%)	41 (55.4)	46 (56.1)	51 (85.0)	**<0.001***
Education level of the mother, n (%)				
Primary school (8 years)	11 (14.9)	12 (14.6)	2 (3.0)	
High school	16 (21.6)	22 (26.8.)	18 (30.0)	0.185
University	47 (63.5)	48 (58.5)	40 (66.7)	
Education level of the father, n (%)				
Primary school (8 years)	12 (16.2)	8 (9.8)	2 (3.3)	
High school	24 (32.4)	26 (31.7)	15 (25.0)	0.076
University	38 (51.4)	48 (58.5)	43 (71.7)	
Family income, n (%)				
High	11 (14.9)	21 (25.6)	32 (53.3)	**<0.001***
Moderate-low	63 (85.1)	61 (74.4)	28 (46.7)	

*: **p<0.001**

Table 2 summarizes the comparison of adherent and non-adherent patients for the disease and treatment characteristics, skin prick test, and spirometric evaluation, C-ACT scores, and the mothers' perceived level of knowledge about disease and treatment. In non-adherent patients, C-ACT scores and the mothers' perceived level of knowledge about disease were significantly lower than those in adherent patients (Table 2). Correlation analyses showed that efficient control of asthma (C-ACT) was positively correlated with patient age ($r=0.164$, $p=0.041$).

The rate of "poor asthma control" was higher in non-adherent patients than in those with adherence to regular ICS use (78.4% vs. 46.3%, $p<0.001$). Besides, the number of mothers with insufficient knowledge of the disease, adverse effects of medications, treatment duration, and the time to follow-up visits were also higher in the former group ($p=0.014$, $p=0.005$, $p=0.023$, and $p=0.023$, respectively).

Complete resolution of symptoms (thinking that her child has recovered due to lack of symptoms) and fear of an adverse event were the prominent reasons for mothers (97.3%) in the non-adherent group (Table 3). Mothers were the most influential person (78.4%) in the decision to discontinue treatment, children themselves being the second (12.2%). Overprotective mothering (PARI 1) and authoritarian attitude scores (PARI 5) of mothers were found to be higher in obesity in children (0.008, 0.031), housewife mothers (<0.001, <0.001), and low education level of parents (<0.001, <0.001, <0.001, and <0.001 respectively) (Table 4).

Although the PARI subtest scores were not different in the two patient groups, mothers of non-adherent patients had less democratic attitudes than the controls ($p=0.030$), and mothers of adherent patients had lower scores in rejecting the homemaking role than the controls ($p=0.039$) (post hoc analyses).

Table 2 Comparison of adherent and non-adherent patients with asthma.

	Non-adherent (n=74)	Adherent (n=82)	p
Asthma severity, n (%)			
Mild persistent	14 (18.9)	23 (28.0)	0.193
Moderate persistent	60 (81.1)	59 (72.0)	
Disease duration (months) (mean ± SD)†	29.7 ± 15.6	29.0 ± 14.9	0.790
Treatment duration (months) (mean ± SD)	13.0 ± 12.2	12.2 ± 9.6	0.650
ICS technique, n (%)			
Metered dose inhaler (MDI)	35 (47.3)	35 (42.7)	0.630
Dry powder inhaler (DPI)	39 (52.7)	47 (57.3)	
No. of medications other than ICS (mean ± SD)	1.4 ± 1.0	1.7 ± 1.0	0.107†
Other atopic disease, n (%)			
Any additional atopic disease	33 (44.6)	27 (32.9)	
Allergic rhinitis	39 (52.7)	49 (59.8)	0.189
Food allergy or atopic dermatitis	2 (2.7)	6 (7.3)	
ICS use in family, n (%)	34 (45.9)	30 (36.6)	0.257
Atopy in family, n (%)	54 (73.0)	54 (65.9)	0.387
Skin Prick Test (SPT), n (%)			
House dust mite	39 (52.7)	47 (57.3)	0.630
Mold	35 (47.3)	29 (35.4)	0.145
Animal dander	15 (20.3)	17 (20.7)	1.000
Grass	45 (60.8)	48 (58.5)	0.870
Tree pollen	21 (28.4)	18 (22.0)	0.363
Ragweed	18 (24.3)	11 (13.4)	0.100
Negative	15 (20.3)	6 (7.3)	
Mono-sensitized	18 (24.3)	22 (26.8)	0.060
Poly-sensitized	41 (55.4)	54 (65.9)	
Perception of mother on having sufficient knowledge about…n (%)			
Asthma	64 (86.5)	79 (96.3)	**0.014***
Adverse reactions	55 (74.3)	74 (90.2)	**0.005***
Treatment duration	69 (93.2)	82 (100)	**0.023***
Time of next visit	69 (93.2)	82 (100)	**0.023***
C-ACT (mean ± SD)	16.0 ± 5.2	20.2 ± 5.2	**<0.001****
Poor asthma control (C-ACT < 19), n (%)	58 (78.4)	38 (46.3)	**<0.001****

†Significance value for the group comparison according to $\chi 2$-test for each number of additional medication (i.e., 1 – additional medication, 2 – additional medication, etc.)
*$p<0.05$, **$p<0.001$

Table 3 Features of non-adherent patients with asthma expressed as n (%).

Reason for non-adherence	
Symptom resolution	37 (50.0)
Concerns about adverse reactions	28 (37.8)
Symptom resolution and concerns about adverse reactions	7 (9.5)
Financial reasons	2 (2.7)
Dominant person in the decision of interruption of treatment	
Mother	58 (78.4)
Child	9 (12.2)
Mother and father	4 (5.4)
Father	3 (4.1)

Anxiety scores of mothers were found to be higher in the non-adherent group (<0.001), poor asthma control (0.032), middle-low family income (0.024), and low education level of fathers (0.002) were the main factors found in the non-adherent group (Table 4).

Discussion

In our study, it was found that mothers' anxiety levels and their knowledge about asthma and medications were associated with treatment adherence in children with asthma. In addition, mothers' attitudes were closely related to parental education and the working status of the mother but not adherence.

Regular ICS use is a crucial intervention for reducing asthma exacerbations, suppressing chronic inflammation, and keeping asthma under control.[14] As in several chronic diseases, treatment non-adherence is one of the key factors in the deterioration of disease control in asthma. In our study, the rate of treatment adherence was 52.6%. In previous studies, adherence to ICS was reported to range between 30 and 70% in patients with asthma.[23] Identifying the factors leading to and preventing poor adherence are required to achieve asthma control.

A previous study found a low adherence to the US asthma guidelines in 285 children (aged 5–11 years) and 211 adolescents (aged 12–18 years) where poorer adherence was related to an older age.[24] Another problem was premature discontinuation of the treatment; among assessed children and adolescents in the US, only less than half had gotten a prescription refill, and 63% had stopped taking asthma medications within 3 months after their first prescription. Disadvantaged families and ethnic minorities were at a higher risk for such an outcome.[3] The factors leading to a decreased adherence included a high number of medications, frequency of inhalation, and inaccuracy of the inhalation technique used by the patient.[25] In our study, the age of children or using a DPI or an MDI with the spacer did not affect the adherence. Neither we did found an effect on the adherence by the number of medications. Although all mothers have been informed about the medications at the initial visit in our study, a significant number of mothers declared that they did not know much about the adverse reactions of ICS. Similar to our study, several others have also emphasized the insufficiency of basic standard information sessions and a need for a patient-based information sheet/schedule that specifically highlights the topics that the patient has concerns about for a more beneficial and efficient relay of information.[26] Insufficient knowledge about asthma and medications has been linked to non-adherence and lower disease control,[5,6] supporting the importance of improved patient education. In our study, only two patients had interrupted the treatment due to financial difficulties and inability to access the medication. All others have interrupted the treatment due to the complete resolution of symptoms and/or concerns about its adverse effects. A study in Egypt asked the parents of 100 asthmatic children about their concerns regarding the ICS therapy; 53% reported side effects, including non-specific side effects (35%), addiction (9%), or weight gain (6%) as their main concern.[27] There is a need for a patient-based and tailored information package to be used in asthma clinics to increase adherence.

In previous studies, rates of depression and anxiety were reported to be higher in families of children with asthma, and both were related to disease severity.[28,29] In a study of 160 children with asthma and 90 healthy children aged 4–15 years, Ozkaya *et al.*[11] found that mothers of children with asthma had higher anxiety and depression levels. Yuksel *et al.*[28] studied 75 asthmatics and 46 healthy children aged 7–16 years and found that the Hospital Anxiety and Depression Scale (HADS) scores were significantly higher in the mothers of children with asthma ($p=0.02$). In our study, mothers' anxiety scores were found to be higher in the non-adherent group, poor asthma controlled, middle-low family income, and low education level of fathers. However, it may not be easy to determine whether a high level of anxiety causes poor asthma control or whether poor asthma control increases anxiety. Amaral *et al.*[30] indicate that the intervention directed to mothers of children/adolescents with asthma was efficient in reducing stress and anxiety, and depression reduction. However, this study could not determine whether stress reduction is useful in asthma control. The study of Yamamoto *et al.*[12] showed that stress, anxiety, and depression in parents were associated with poor outcomes in children with asthma. For this reason, we think that evaluating the psychological status of the families of children with chronic diseases such as asthma and providing the necessary treatments is critical in controlling their children's diseases.

Maternal attitudes greatly differ among different cultures. Studies have reported higher scores for parents of children with asthma in the attitudes of hostility and rejection of homemaking role, overprotective mothering, and authoritarian attitudes than the parents of healthy children.[10] In our study, maternal attitudes (overprotective mothering and authoritarian attitude scores) of mothers of children with asthma were higher in obese children, housewife mothers, and parents' low education level. In different studies, the effect of parents' attitudes on children's diseases was investigated in children with chronic diseases. Overprotective mothering and authoritarian attitude scores were found to be higher in mothers of obese children.[31] In another study on mothers of children with cystic fibrosis, it was shown that the mothers' working and education level of mothers affected their child-rearing attitudes.[32]

Table 4 Comparison of PARI and BAI scores according to adherence, asthma severity, asthma control, family income, mother's working status, and parents' education level.

	PARI 1 (mean ± SD)	p	PARI 2 (mean ± SD)	p	PARI 3 (mean ± SD)	p	PARI 4 (mean ± SD)	p	PARI 5 (mean ± SD)	p	BAI medium (IQR) [min-max]	p
Groups												
Controls (n = 60)	37.1 ± 7.5	0.225	25.6 ± 3.1	**0.036***	27.6 ± 6.9	**0.042***	13.3 ± 4.6	0.488	30.1 ± 7.7	0.674	3.0 (6.0) [0.0-12.0]	**<0.001**
Non-adherent (n = 74)	39.8 ± 10.0		23.8 ± 4.2		25.3 ± 6.8		12.6 ± 4.0		30.8 ± 9.1		9.0 (13.0) [0.0-37.0]	
Adherent (n = 82)	38.0 ± 9.3		24.9 ± 4.4		24.7 ± 7.1		12.4 ± 4.2		30.1 ± 7.7		3.0 (7.0) [0.0-38.0]	
Asthma severity												
Mild persistent (n = 37)	36.8 ± 8.0	0.153	23.7 ± 3.6	0.279	24.8 ± 7.2	0.829	12.1 ± 4.3	0.510	28.4 ± 6.0	0.152	3.0 (10.0) [0.0-37.0]	0.247
Moderate persistent (n = 119)	39.4 ± 10.0		24.6 ± 4.5		25.1 ± 6.9		12.6 ± 4.0		30.7 ± 9.4		6.0 (10.0) [0.0-38.0]	
Asthma control												
Controlled (n = 60)	38.6 ± 9.3		24.5 ± 4.8		24.5 ± 6.9		12.5 ± 4.2		29.1 ± 8.5		3.0 (8.0) [0.0-38.0]	
Poorly controlled (n = 96)	39.0 ± 9.8	0.800	24.2 ± 4.1	0.683	25.3 ± 7.0	0.435	12.5 ± 4.0	0.916	30.9 ± 8.9	0.217	7.0 (11.0) [0.0-30.0]	**0.032**
Body mass index												
Normal (<85.p) (n = 176)	37.6 ± 8.7	**0.008***	24.5 ± 4.0	0.166	25.8 ± 7.1	0.825	12.6 ± 4.4	0.265	29.6 ± 8.1	**0.031**	4.5 (10.0) [0.0-38.0]	0.695
Overweight-Obesity (>85p) (n = 40)	41.8 ± 10.0		25.5 ± 4.2		25.5 ± 6.5		13.4 ± 3.2		32.8 ± 9.6		7.0 (10.0) [0.0-30.0]	
Family Income												
High (n = 64)	35.6 ± 7.9	**0.003***	24.2 ± 3.5	0.299	25.3 ± 7.3	0.563	12.1 ± 4.0	0.190	28.6 ± 7.7	0.078	4.0 (8.0) [0.0-30.0]	**0.024**
Moderate-low (n = 152)	39.5 ± 9.3		24.9 ± 4.3		25.9 ± 6.9		12.9 ± 4.3		30.8 ± 8.7		6.0 (10.0) [0.0-38.0]	
Working status of mothers												
Housewife (n = 78)	41.6 ± 9.5	**<0.001****	25.4 ± 4.4	0.071	26.0 ± 7.4	0.619	13.4 ± 4.3	0.092	33.5 ± 10.3	**<0.001**	6.0 (14.0) [0.0-38.0]	0.272
Working mother (n = 138)	36.5 ± 8.4		24.3 ± 3.9		25.6 ± 6.8		12.3 ± 4.1		28.2 ± 6.5		4.0 (8.0) [0.0-37.0]	
Education level of the mother												
Primary school (n = 25)	44.8 ± 8.4	**<0.001****	25.9 ± 3.8	**0.002***	27.6 ± 6.8	0.293	13.8 ± 3.6	**0.006***	36.0 ± 9.4	**<0.001**	3.0 (18.0) [0.0-38.0]	0.674
High school (n = 56)	41.0 ± 8.9		26.0 ± 4.0		25.9 ± 6.9		13.9 ± 4.4		32.9 ± 9.2		6.0 (12.0) [0.0-30.0]	
University (n = 135)	36.4 ± 8.5		23.9 ± 4.0		25.3 ± 7.1		12.0 ± 4.1		27.9 ± 7.1		4.0 (8..0) [0.0-37.0]	
Education level of the father												
Primary school (n = 22)	46.4 ± 7.0	****<0.001**	26.9 ± 3.9	**0.001****	27.4 ± 5.3	0.081	13.5 ± 3.3	**0.037***	36.9 ± 8.7	**<0.001**	11.5 (14.0) [0.0-38.0]	**0.002**
High school (n = 65)	40.7 ± 9.3		25.6 ± 3.9		26.9 ± 7.9		13.6 ± 4.3		33.1 ± 9.4		3.0 (9.0) [0.0-29.0]	
University (n = 129)	35.8 ± 8.2		23.9 ± 4.0		24.8 ± 6.7		12.1 ± 4.2		27.5 ± 6.6		4.0 (9.0) [0.0-37.0]	

PARI: Parent attitude research instrument; **PARI 1:** Overprotective mothering; **PARI 2:** Democratic attitude and equality; **PARI 3:** Hostile rejection of homemaking role; **PARI 4:** Marital conflict; **PARI 5:** Authoritarian attitude; **BAI:** Beck anxiety inventory. *:$p<0.05$, **: $p<0.001$

Also, it has been shown that the mother's low education level, low socioeconomic level, and parental attitude problems, especially authoritarian attitude, increase the risk of functional constipation.[33] In previous studies, low parental education has been associated with uncontrolled asthma.[9] In our study, we did not observe any significant effect of maternal attitude on adherence and asthma control. However, parental education level was found to be associated with maternal attitude. Mothers of children with asthma who had lower education were more prone to be over-protective and authoritarian. Moreover, this was still a significant issue in the non-adherent group compared to the adherent group. It could be proposed that an over-protective attitude could provoke the mother to interrupt the treatment in an attempt to protect her child from adverse effects, which might lead to poor disease control.

This study is subject to several limitations. Only the mothers' anxiety and attitudes were inquired, while the other members in the family and inter-individual relations were not investigated. In our study, only school-age children were evaluated. Although the primary efficacy of this age in treatment adherence is not known as adolescents, it is a limitation of our study that it was not evaluated in the treatment adherence of children in our study. However, in Turkish culture, mothers generally care for the physical and psychological needs of children. Accordingly, mothers were found to dominate the decision-making process for the interruption of medications. Secondly, we used self-report questionnaires to evaluate anxiety and adherence, which could affect the reliability of the results and cause bias. Regardless, we believe that our results would be useful in understanding the reasons underlying the non-adherence in children with asthma.

In conclusion, approximately 50% of children with asthma poorly adhered to the ICS treatment. A high level of anxiety in mothers and the perceived lack of knowledge about the disease had unfavorable effects on their adherence to the treatment. In light of these findings, psychological and educational support to families of children with asthma would improve treatment adherence and efficacy. Nevertheless, additional studies are needed, especially concerning the triggers of non-adherence.

Acknowledgments

We would like to thank Dr. Irem Tiftikcioglu for her valuable and constructive contributions and critical review of the manuscript.

The English in this document has been checked by at least two professional editors, both native speakers of English.

Funding

This study did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Conflicts of interest

The authors have no conflict of interest to be declared.

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